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EXAMINER	
COHEN, AMY R	
ART UNIT	**PAPER NUMBER**
2859	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/926,015	Applicant(s) SUGDEN ET AL.	
	Examiner Amy R Cohen	Art Unit 2859	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-51 and 54* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-51 and 54* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 January 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 5 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Specification

1. This application does not contain an abstract of the disclosure as required by 37 CFR 1.72(b). An abstract on a separate sheet is required.

Claim Objections

2. Claims objected to because of the following informalities:

Claim 9, line 1, claim 16, line 2, claim 24, line 3 "the refractive index profiles" lacks proper antecedent basis in the claims.

Claim 20, line 4 "the beam paths" lacks proper antecedent basis in the claims.

Claim 25, line 2 "the refractive index" lacks proper antecedent basis in the claim.

Claim 33, line 2 "the same rate of chirp" and "the same spectral bandwidth" lack proper antecedent basis in the claims.

Claim 21 claim language is confusing because "the sensor in which the or each region in the fibre Bragg grating is formed in a fibre Bragg grating fabricated" appears to be redundant.

Claim 37, line 1 "according" has a space between the c's.

Claim 39, lines 1-2 "the sensor in which a first part of the chirped grating having a first spectral bandwidth is represented on a phase-mask and subsequently inscribed into the fibre" is awkward grammar.

In the claims, the phrase "the or each" makes the claim language confusing and appears to be related to the claim language prior to the Pre-Amendment filed. Please correct the grammar in the claims which use the phrase "the or each" to indicate if one or more fibre gratings is claimed.

In the claims, the phrase "subsequently" is unclear because it is unclear as to what is meant by subsequent since the claims are apparatus claims and not method claims comprising steps of a method.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-31, 35-49, 51 are rejected under 35 U.S.C. 102(b) as being anticipated by Rao, Yun-Jiang "In Fibre Grating Sensors" *Measurement Science and Technology* [hereinafter Rao].

Rao teaches a fibre optic grating sensor (Fig. 1) comprising an optical fibre (Fig. 1) having a grating portion along which the refractive index of the fibre varies periodically, the periodic variation having an amplitude envelope which includes at least one region in which the amplitude of the envelope is substantially reduces (page 356, paragraph 2.1), the said variation giving the grating portion a spectral profile within which there is at least one pass band (Fig. 2).

Rao teaches the sensor in which the amplitude envelope includes a plurality of regions in which the amplitude of the envelope is substantially reduced (pages 356-357, paragraphs 2.1-2.2 and Fig. 2).

Rao teaches the sensor in which the amplitude envelope includes a plurality of regions in which the amplitude of the envelope is substantially nulled (pages 356-357, paragraphs 2.1-2.2 and Fig. 2).

Rao teaches the sensor in which the periodic variation in the or each region includes a section in which the phase of the periodic variation substantially reverses (pages 363-364, paragraph 4.1.3 and Fig. 8).

Rao teaches the sensor in which adjacent regions are spatially separated (page 356, paragraph 2.1 and Figs. 1 and 2).

Rao teaches the sensor in which the or each region gives rise to a corresponding pass band (page 356, paragraph 2.1 and Figs. 1 and 2).

Rao teaches the sensor in which each region is an independently actuable sensor element operable to vary the wavelength of the corresponding pass band in response to a change in a parameter being measured (pages 357-358 paragraphs 2.2-2.2.3).

Rao teaches the sensor in which the grating portion comprises two substantially superimposed fibre Bragg gratings (page 359 paragraph 2.2.5.2).

Rao teaches the sensor in which the amplitudes of the refractive index profiles of the two grating add together to form the amplitude envelope (page 359 paragraphs 2.2.5.3-2.2.5.4).

Rao teaches the sensor in which the fibre Bragg gratings are chirped fibre Bragg gratings (page 357 paragraph 2.2.1).

Rao teaches the sensor in which the two chirped gratings have substantially the same rate of chirp and substantially the same spectral bandwidth, the first chirped grating having a different central wavelength to the second chirped grating (pages 357-360 paragraphs 2.2-2.2.5.6).

Rao teaches the sensor in which the first chirped grating has a different rate of chirp to the second chirped grating, and the two chirped gratings have substantially the same central wavelength and bandwidth (pages 357-360 paragraphs 2.2-2.2.5.6).

Rao teaches the sensor in which the fibre Bragg gratings are linear fibre Bragg gratings (page 357 paragraph 2.2.1).

Rao teaches the sensor in which the two linear gratings have substantially the same spectral bandwidth (page 357 paragraph 2.2.1).

Rao teaches the sensor in which the first linear grating has a different central wavelength to the second linear grating (pages 361-363 paragraphs 3.1-3.2.3).

Rao teaches the sensor in which the grating portion comprises one fibre Bragg grating having a plurality of regions within which the refractive index profile of the grating is substantially reduced or nulled (page 356 paragraph 2.1 and Fig. 1).

Rao teaches the sensor in which the fibre Bragg grating is a linear grating or a chirped grating (page 357 paragraph 2.2.1 and Fig. 2).

Rao teaches the sensor in which the or each fibre Bragg grating is fabricated using a two-beam interference holographic fabrication method (page 361 paragraphs 3.1-3.1.1, Fig. 4).

Rao teaches the sensor in which the or each fibre Bragg grating is fabricated using a phase-mask method (pages 361-363 paragraphs 3.2.1-3.2.2, Fig. 6).

Rao teaches the sensor in which the or each region in the fibre Bragg grating is fabricated using the two-beam interference holographic fabrication method by providing an amplitude mask generally in front of the fibre, generally in the beam paths, during fabrication (page 361 paragraph 3.1.2 and Fig. 5).

Rao teaches the sensor in which the or each region in the fibre Bragg grating is formed in a fibre Bragg grating fabricated using one of the two-beam interference holographic method and the phase-mask fabrication method by subsequently exposing the regions of the grating (pages 361-363 paragraphs 3.1-3.2, Figs. 4-7).

Rao teaches the sensor in which the grating portion comprises a single grating structure fabricated using a phase-mask method (pages 361-362 paragraph 3.2.1).

Rao teaches the sensor in which the desired grating structure is represented on a phase-mask and subsequently inscribed into the fibre through the phase-mask (pages 361-362 paragraph 3.2.1).

Rao teaches the sensor in which the grating structure is inscribed in the fibre through a phase-mask while the fibre undergoes oscillating motion along its longitudinal direction, relative to the phase-mask, to thereby control the refractive index profile within the grating structure (page 363 paragraph 3.2.3).

Rao teaches a fibre optic grating sensor comprising an optical fibre having a grating portion along which the refractive index of the fibre varies periodically, the periodic variation including at least one section in which the phase of the periodic variation substantially reverses, the said variation giving the grating portion a spectral profile within which there is at least one pass band (pages 363-364 paragraphs 4.1-4.1.3 Fig. 8).

Rao teaches the sensor in which the grating portion includes a plurality of sections in which the phase of the periodic variation substantially reverses (pages 363-364 paragraphs 4.1-4.1.3 Fig. 8).

Rao teaches the sensor in which the adjacent phase reversal sections are spatially separated (pages 363-364 paragraphs 4.1-4.1.3 Fig. 8).

Rao teaches the sensor in which the or each phase reversal section gives rise to a corresponding pass band (pages 363-364 paragraphs 4.1-4.1.3 Fig. 8).

Rao teaches the sensor in which each section is an independently actuable sensor element operable to vary the wavelength of the corresponding pass band in response to a change in a parameter being measured (pages 365-366 paragraph 4.3.1-4.3.3).

Rao teaches the sensor in which the period of the periodic variation changes along substantially the full length of the grating portion (pages 365-366 paragraph 4.3.1-4.3.3).

Rao teaches the sensor in which the grating portion comprises two substantially overlapping chirped Bragg gratings, the first chirped grating being spatially shifted relative to the second chirped grating by an integer plus a fraction of the period of the first grating (page 363 paragraph 3.2.3).

Rao teaches the sensor in which the two chirped gratings have substantially the same rate of chirp and substantially the same spectral bandwidth, the first chirped grating having a different central wavelength to the second chirped grating (pages 362-366 paragraphs 3.2.2-4.4).

Rao teaches the sensor in which the first chirped grating has a different rate of chirp to the second chirped grating, and the two chirped gratings have substantially the same central wavelength and bandwidth (pages 362-366 paragraphs 3.2.2-4.4).

Rao teaches the sensor in which the fibre Bragg gratings are fabricated using a known two-beam holographic fabrication method (page 361 paragraphs 3.1-3.1.2).

Rao teaches the sensor in which the fibre Bragg gratings may be fabricated using a known phase-mask method (pages 361-363 paragraphs 3.2-3.2.3).

Rao teaches the sensor in which the grating portion comprises one chirped fibre Bragg grating having a plurality of sections in which the phase of the periodic variation substantially reverses (pages 363-366 paragraph 4.1.3 and 4.3.1).

Rao teaches the sensor in which the single chirped fibre Bragg grating is fabricated using a known phase-mask fabrication technique (pages 361-363 paragraphs 3.2-3.2.3).

Rao teaches the sensor in which a first part of the chirped grating having a first spectral bandwidth is represented on a phase-mask and subsequently inscribed into the fibre (pages 361-363 paragraphs 3.2-3.2.3).

Rao teaches the sensor in which a second part of the chirped grating having a second spectral bandwidth is inscribed into the fibre substantially spatially and spectrally adjacent the first part, the first and second parts together forming the chirped grating (pages 361-363 paragraphs 3.2-3.2.3).

Rao teaches the sensor in which the chirped grating comprises a plurality of such parts arranged substantially spatially and spectrally sequentially adjacent one another (pages 361-363 paragraphs 3.2-3.2.3).

Rao teaches the sensor in which the chirped grating the fibre is under a first strain during inscription of the first part (pages 363-364 paragraphs 3.2.3 and 4.1-4.1.4).

Rao teaches the sensor in which the fibre is under a first strain during inscription of the first part and is under a second strain during inscription of the second part, the first and second strains being different (pages 363-364 paragraphs 3.2.3 and 4.1-4.1.4).

Rao teaches the sensor in which the chirped grating is fabricated using a single phase-mask, the desired structure of the chirped grating being represented on the phase-mask and subsequently inscribed into the fibre through the phase-mask (pages 361-363 paragraphs 3.2-3.2.3).

Rao teaches the sensor in which the chirped grating is fabricated using a known continuous writing technique (pages 361-363 paragraphs 3.2-3.2.3).

Rao teaches the sensor in which the optical fibre is photosensitive enhanced optical fibre (pages 356-357 paragraphs 2.1-2.2).

Rao teaches the sensor in which the photosensitive enhanced optical fibre is germania doped optical fibre, or boron-germania co-doped optical fibre (pages 356-357 paragraphs 2.1-2.2).

Rao teaches the sensor in which the fibre is hydrogen loaded to increase the photosensitivity of the fibre (page 361 paragraph 3.1).

Rao teaches the sensor in which the hydrogen loaded fibre is annealed following fabrication of the grating structure to substantially remove any residual hydrogen from the fibre (page 361 paragraph 3.1).

Rao teaches the sensor in which the fibre grating sensor comprises a plurality of grating portions (Figs. 1-3, 9, 16-20).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Rao.

Rao discloses the sensor as described above in paragraph 4.

Rao does not disclose the sensor wherein the first chirped grating is spatially shifted relative to the second chirped grating by an integer plus one half of the period of the first grating.

Regarding the spatial shift: Rao discloses a sensor where the first chirped grating is spatially shifted relative to the second chirped grating. However, to choose a shift of an integer plus one half the period of the first chirped grating between the gratings, absent any criticality, is only considered to be the "optimum" value of the shift between the gratings, as stated above, that a person having ordinary skill in the art would have been able to determine using routine experimentation based, among other things, on the desired accuracy and since it has been held

that discovering an optimum value of a result effective variable involves only routine skill in the art. See ***In re Boesch***, 205 USPQ 215 (CCPA 1980).

7. Claims 50 and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rao in view of Ouellette et al. (PCT WO 96/24079).

Rao discloses the sensor as described above in paragraph 4.

Rao does not disclose a sensor in which the grating portion comprises a surface-relief grating structure side-etched in an optical fibre.

Ouellette et al. discloses the sensor in which the grating portion comprises a surface-relief grating structure side-etched in an optical fibre (page 4, lines 16-36).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the sensor of Rao to include the surface-relief, side-etched grating structure, as taught by Ouellette et al., so that the phase relationship is constant and as another method of forming the gratings onto the optical fibre.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The following patents disclose optical fiber sensors Harumoto et al. (U. S. Patent No. 6,021,242), Miller et al. (U. S. Patent No. 5,838,437), Bakhti et al. (U. S. Patent No. 5,818,987), Narendran (U. S. Patent No. 5,760,391), Kersey (U. S. Patent No. 5,757,487), Painchaud et al. (U. S patent No. 5,748,814), and Kashyap et al. (U. S. Patent No. 5,384,884).

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Amy R Cohen whose telephone number is (703) 305-4972. The examiner can normally be reached on 8 am - 5 pm, M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Diego Gutierrez can be reached on (703) 308-3875. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 306-3431.

ARC
May 5, 2003

Diego Gutierrez
Supervisory Examiner
Tech Center 2800